Marine Physical Laboratory

Backscatter Data Acquisition for Hydrosweep DS Aboard RV Ewing

Christian de Moustier

Final Report to the Office of Naval Research Grant N00014-90-J-1781 For the Period 2-1-91 - 6-30-94



19950321 009

MPL-U-141/94 December 1994

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University of California, San Diego Scripps Institution of Oceanography

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

Public reporing burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data need ed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. Agency Use Only (Leave Blank).

2. Report Date.

3. Report Type and Dates Covered.

1. Agency Use Only (Leave B	Use Only (Leave Blank). 2. Report Date. December 1994 3. Report Type and Final Re		3. Report Type and Da Final Repo	tes Covered. Ort	
4. Title and Subtitle.					5. Funding Numbers.
Backscatter Data Acquisition for Hydrosweep DS Aboard RV Ewing					N00014-90-J-1781
6. Author(s).					
Christian de Moustier					Project No. Task No.
7. Performing Monitoring Agency Names(s) and Address(es).					8. Performing Organization Report Number.
University of California, San Diego Marine Physical Laboratory Scripps Institution of Oceanography San Diego, California 92152-6400					MPL-U-141/94
9. Sponsoring/Monitoring Agency Name(s) and Address(es).					10. Sponsoring/Monitoring Agency Report Number.
Office of Naval Research Department of the Navy 800 North Quincy Street Arlington, VA 22217-5660 Code 324OA					Report Number.
11. Supplementary Notes.					
12a. Distribution/Availability Statement.					12b. Distribution Code.
•					125. Distribution Godo.
Approved for public release; distribution is unlimited.					
13. Abstract (Maximum 200 words).					
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14. Subject Terms.					15. Number of Pages.
multibeam echo-sounding, data acquisition, seafloor remote sensing					3
					16. Price Code.
17. Security Classification of Report. Unclassified	of This	ty Classification Page. lassified	19. Secu of Ab	rity Classification stract Unclassified	20. Limitation of Abstract. None

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Abstract

The long term objectives of this work are to establish efficient and accurate signal processing techniques for seafloor remote sensing operations aimed at characterizing the bottom by acoustic methods. This work focuses on acoustic measurements made with a Hydrosweep DS multibeam echo-sounding system installed aboard R.V. M. Ewing. The objectives are to design and implement a data acquisition scheme that preserves base-banded quadrature samples of the output of individual hydrophone staves.

BACKGROUND

Experience gained at the Marine Physical Laboratory with the 16-beam Sea Beam multibeam echo-sounder system led to the design and implementation of acoustic data acquisition systems [de Moustier and Pavlicek, 1987] to record base-banded quadrature samples of the signals received by the 16 preformed beams. Acoustic data collected with this system allowed us to investigate ways of (1) achieving reliable bottom classification by acoustic means [e.g. de Moustier and Alexandrou, 1991; de Moustier and Matsumoto, 1993], and (2) improving the signal processing functions [de Moustier, 1993].

Following advances in operation and integration of the Hydrosweep DS system made aboard R.V. Ewing at the Lamont Doherty Earth Observatory [Chayes et al, 1991], there was scientific interest in improving the beamforming, echo detection and backscatter imaging capabilities of the system. This required developing a system to preserve the acoustic data received by the system at each of its 72 hydrophone staves.

APPROACH

The approach consists of tapping the digital output of each hydrophone channel, performing a base-banding operation and retaining enough samples to provide about twice the Nyquist rate for later processing. These acoustic data are then recorded along with system parameters such as gain settings, pulse length, and transmission mode, and ship attitude data.

ACCOMPLISHMENTS & RESULTS

After reviewing the internal functions of the Hydrosweep DS system, we designed a data acquisition and signal processing architecture and set out to implement it aboard ship. The work was done in collaboration with Dale Chayes, at Lamont Doherty Earth Observatory, who built and implemented the data acquisition system aboard R.V. Ewing. First order tests were conducted during the geophysical survey of the ONR Acoustic Reverberation SRP in July 1992. However, in this initial effort, we learned that the interface to the existing 8-bit digital data was not suitable because of its low dynamic range and the complexity of tapping the current-loop parallel digital data. A second attempt was made, this time to acquire the analog output of the 72 preamps using 16-bit delta-sigma A/D converters. A two channel prototype was built and tested. Hydrosweep support at Lamont lapsed before this data acquisition system could be made fully operational.

Publications

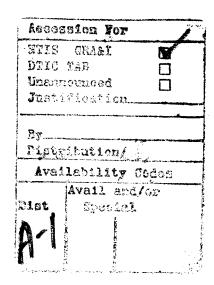
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